

Statement of

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Good morning, Mr. Chairman. Thank you for the opportunity to discuss the effects of rapid economic growth in developing countries on global mineral markets and on the United States economy, national security, and the global environment. This statement describes the link between mineral consumption and economic development; outlines, in particular, how China's development is affecting mineral markets; and, examines some implications of this development. This information is based upon a recently released U.S. Geological Survey (USGS) Open-File Report 2004-1374, "China's growing appetite for minerals."

The USGS, through its Mineral Resources Program, is the primary Federal provider of scientific and economic information for objective resource assessments and unbiased research results on national and international mineral potential, production, trade, consumption, and environmental effects. This USGS role is clearly defined and unique from other Federal, State, local or private entities. These USGS activities provide information ranging from that required for land planning decisions on specific management units to that required for national and international economic, foreign policy and national security decisions.

One of the major international news stories of 2004 was the rapid growth of the Chinese economy. China's growth earned headline status because China is consuming large amounts of raw materials and is becoming a more important factor in global trade and economic growth in other countries. Development on the scale that is now occurring is greatly increasing world consumption of minerals and will affect patterns of mineral production, trade, and consumption.

The Connection Between Minerals and Economic Development

For many developing countries, economic growth has just begun; however, China's economic growth is not new. Since the late 1980s, economic growth in China has been between 7 and 9 percent annually, doubling the economy every 8 to 10 years. China has been undergoing industrialization, moving through a series of stages that include development of infrastructure, followed by development of light manufacture, development of heavy manufacture, increased consumption of consumer goods, and finally, by the development of a service economy. Based upon the experiences of the

Federal Republic of Germany and Japan during the post-World War II period, and of the Republic of Korea in the period 1970-95, changes begin at roughly 5-year intervals and each of the stages takes about 20 years to complete- with stages overlapping. During each stage of economic development, consumption of particular mineral commodities rises dramatically.

For example, the first or infrastructure stage is characterized by large increases in consumption of cement, crushed stone, and sand and gravel; cement consumption may rise from a few tens of kilograms per person per year to 0.5 to 1 ton of cement per person per year. During the second or light manufacturing stage, consumption of copper may increase from less than a kilogram per person per year to around 10 kilograms per person per year. In the third or heavy manufacturing stage, consumption of aluminum, iron ore, and steel rises. For example, aluminum consumption typically increases from less than a kilogram per person per year to 10 to 30 kilograms per person per year. The consumer goods stage of development is characterized by increased consumption of durable goods such as automobiles. Increases in the consumption of metals with specialty applications such as nickel, which is used in stainless steel, industrial minerals, and fuels are characteristic of the fourth or consumer goods stage. Finally, high but static rates of per capita consumption of minerals in finished goods are characteristic of the ultimate services stage.

China's per capita consumption of copper (about 2.5 kg in 2004) suggests that it is about 20 to 30 percent of the way through the light manufacturing stage of development.

How Chinese Economic Growth is Affecting World Mineral Markets

USGS analysis indicates that China's rising consumption of mineral commodities has resulted in higher prices and lower stocks of mineral commodities such as aluminum, copper, gold, iron ore, nickel, platinum-group metals, and tin. Another result has been high levels of use of world production capacity for many commodities. This has left little excess capacity to handle supply disruptions. In some cases, shortages of mineral commodities have caused manufacturers to limit their production of goods. World demand for iron ore, iron and steel scrap, blast furnace coke and steel has been especially strong. This contrasts strongly with the situation of 2001 when analysts argued that 10 to 20 percent of steel capacity was unneeded. As with other mineral commodities, most of the increase in steel demand has come from China. The USGS has received numerous contacts recently from companies trying to find sources of iron ore and steel, including those used in the manufacture of automobile axles and in defense applications.

China is the leading producer of a number of minerals including aluminum, antimony, cement, fluorspar, coking coal, magnesium, rare earths, steel, tin, tungsten, and zinc. However, because of the demands of its economy, Chinese exports of mineral commodities such as rare-earth elements, silver, tin, and tungsten, are declining. China controls exports of some mineral commodities such as antimony, coking coal, and tungsten by requiring an export permit. China also maintains duties on exports of some mineral commodities. China is a significant source for a number of mineral commodities

for which the United States is dependent upon imports for most of its supply. These include antimony (79 percent of imports), barite (90 percent), fluorspar (65 percent), indium (49 percent), magnesium compounds (68 percent), rare earths (67 percent), tungsten (47 percent), and yttrium (88 percent). These mineral commodities have important uses in applications such as batteries, ceramics, electronic equipment, flame resistant materials, metallurgical processing, and petroleum drilling.

In order to meet the needs of its rapidly growing economy, China has had to increase both its production and imports of minerals commodities. China's large aluminum, copper, and steel industries are dependent upon imports of raw materials. As a result, China has made significant foreign investment in bauxite and alumina, copper, iron ore, and nickel production facilities. Last fall, state-owned China Minmetals Corporation entered into discussions to purchase the Canadian company Noranda, Inc. Although those negotiations have not resulted in an agreement to date, they are indicative of interest by China in owning sources of the mineral commodities that its industries rely upon. China's rapid economic development and increased consumption of mineral commodities are also increasing environmental residuals released into the environment.

Some Possible Implications of the Rapid Economic Growth in Developing Countries

USGS analysis of mineral consumption patterns shows that continued strong economic growth in China and other developing countries with large populations has some important implications.

1. China and other developing countries are likely to follow general patterns of development. China is now well along in its light manufacturing stage and has begun to develop its heavy industry and even to consume durable goods such as automobiles. If Chinese consumers follow the example of their Japanese, Korean, Malaysian, and Taiwanese neighbors, Chinese auto ownership could rise from about 10 to 100 autos per thousand people within the next 7 to 10 years. Unless there is a significant improvement in automobile engines, this could create a significant increase in environmental residuals.
2. Increased environmental residuals from developing countries will become a major issue both domestically in the developing countries and internationally. Transnational flows of environmental residuals could increase disputes between nations.
3. Increased competition could take place among countries seeking sources of mineral commodities to supply industrial production. National policies regarding domestic and international resource ownership and policies concerning mineral exports are examples of ways that governments could attempt to secure advantages for domestic industries.
4. As the developing countries increase their per capita income, several changes are likely. Higher national incomes are likely to lead to increased consumption of

mineral commodities. At the same time, higher national incomes are likely to increase resistance to mineral production because preferences for environmental goods and services increase with income. This could create difficulties for companies seeking to increase exploration for new mineral deposits and to extend lives for some deposits that were thought to be reaching the end of their production.

5. Increased volatility in mineral prices could result from slowdowns in developing economies, which are producing and consuming very large quantities of mineral commodities. If during such a downturn, developing countries turn their growing capacity to produce mineral commodities to exports to developed countries, significant trade disputes could take place. The rapid increase in imports of cement from Asia into the United States following the downturn of Asian economies in 1997 is a small example of what could happen.
6. In developed countries, high prices and increased competition for mineral commodities could bring additional economic pressure on manufacturers. New strategies could be developed that would use information technologies together with innovations in product design to reduce the costs of disassembling durable goods at the end of life of products and of sorting materials. This could increase reuse, remanufacture, and recycling of components and help manufacturers to avoid high cost new materials.
7. Rapid changes in mineral consumption are creating conditions where reliable information for economic and national security planning and developing public policies will be increasingly important.
8. Continued growth of the economies of China and other large developing countries could result in a period of rising real prices for mineral commodities. This would be in contrast to the last 30 years, during which real prices of many minerals have declined. Over the next 20 years, mineral commodity price trends may more closely resemble the period from 1950 to 1970 than the last 30 years because of the proportion of the world's economies undergoing development.

The rapid economic growth in developing countries is greatly increasing global mineral consumption, changing global patterns of mineral production, trade, and increasing releases to the environment. These changes have important implications for the economy and national security of the United States.

Thank you, Mr. Chairman, for the opportunity to discuss this important matter, and in so doing, to showcase the significant information gathering and analytical capabilities resident in the USGS.